CLAIMS

1.- A device (100) allowing magnetic property interaction, the device comprising
- a layer comprising piezoelectric material, said layer being adapted for transporting a surface acoustic wave having a frequency ν_{SAW}, and
- at least one ferromagnetic element (106), having a ferromagnetic resonance frequency ν_{FMR} and being capable of magneto-elastic energy conversion,
wherein said surface acoustic wave frequency ν_{SAW} is substantially equal to said ferromagnetic resonance frequency ν_{FMR} or an integer multiple of said ferromagnetic resonance frequency ν_{FMR} such that said surface acoustic wave interacts with said at least one ferromagnetic element (106) to influence a magnetisation state of said ferromagnetic element (106).

2.- A device according to claim 1, said device furthermore comprising at least one surface acoustic wave generating means (102) for generating said surface acoustic wave having a frequency ν_{SAW}.

3.- A device (100) according to any of the previous claims, wherein said frequency ν_{SAW} lies in a range having a width corresponding to a certain fraction of a width of an absorption peak corresponding with said ferromagnetic resonance frequency value ν_{FMR} or an integer multiple thereof , and which is centred around the ferromagnetic resonance frequency value ν_{FMR} or around an integer multiple thereof, said fraction being 100%, preferably 50 %, more preferably 25%, even more preferably 10 %, still more preferably 2% or even still more preferably 1%.

4.- A device according to any of the previous claims, wherein said integer is an even integer number, as for instance 2.

5.- A device according to any of the previous claims, wherein said ferromagnetic element (106) is in contact with said layer comprising piezoelectric material or with said surface acoustic wave generating means (102).

6.- A device (100) according to any of claims 1 to 4, wherein said ferromagnetic element (106) is not in direct contact with said surface acoustic wave generating means (102).

7.- A device (100) according to any of claims 1 to 4, wherein said ferromagnetic element (106) is a part of said surface acoustic wave generating means (102).

8.- A device (100) according to any of the claims 1 to 7, wherein said surface acoustic wave generating means (102) comprises part of said layer comprising said piezoelectric material.

9.- A device (100) according to any of the previous claims wherein the propagated surface acoustic wave creates an effective magnetic field due to magneto-elastic energy conversion in said ferromagnetic element (106) so as to manipulate a magnetic property of said ferromagnetic element (106).

10.- A device according to any of the previous claims, further comprising a means for generating an additional magnetic field at the ferromagnetic resonance frequency or an integer multiple of said ferromagnetic resonance frequency ν_{FMR}.

11.- A device (100) according to any of claims 9 to 10, whereby said magnetic property is the magnetisation state of said ferromagnetic element (106).

12.- A device (100) according to any of the previous claims, wherein said ferromagnetic element (106) is a functional or structural part of a magnetic component (200).

13.- A device (100) according to claim 12, whereby said magnetic component (200) is a magnetoresistive device or said magnetic component comprises a spin valve or a tunnel junction.

14.- A device (100) according to any of claims 9 to 13, whereby the angle between the direction of an easy axis of said ferromagnetic element (106) and the direction of said effective magnetic field is different from 0°, preferably is larger than 45°, more preferably is larger than 80°, most preferably is 90°.

15.- A device (100) according to any of the claims 2 to 14, whereby said surface acoustic wave generating means (102) is at least one Inter Digitated Transducer.

16.- A device (100) according to any of the claims 2 to 15, whereby said device has a further surface acoustic wave generating means (402).

17.- A device (100) according to claim 16, whereby said surface acoustic wave generating means (102) is generating a shear wave in a first surface acoustic wave propagation direction and said further surface acoustic wave generating means (402) is generating Rayleigh waves in a second surface acoustic wave propagation direction.

18.- A device (100) according to claim 17, whereby said first surface acoustic wave propagation direction and said second surface acoustic wave propagation direction are orthogonal on each other.

19.- A device (100) according to any of claims 2 to 18, whereby said device has for at least one surface acoustic wave generating means (102) a surface acoustic wave detection means positioned opposed to said saw generating means relatively to said ferromagnetic element.

20.- A device (100) according to any of the claims 1 to 19, comprising a plurality of ferromagnetic elements (106) ordered on top of said layer comprising piezoelectric material or said surface acoustic wave generating means.

21.- A method for sensing an environmental parameter, said method comprising the steps of

- allowing at least one ferromagnetic element (106) to interact with an environment of which a environmental quantity has to be measured
- generating a surface acoustic wave in a layer comprising piezoelectric material, interacting with said at least one ferromagnetic element (106)
- dynamically measuring the variation of a characteristic parameter influenced by said ferromagnetic element (106)
- deriving from said variation of a characteristic parameter a corresponding value of a physical quantity of said ferromagnetic element (106).

22.- A method according to claim 21, wherein said physical quantity of said ferromagnetic element (106) is a magneto resistance of said ferromagnetic element (106).

23.- A method according to any of claims 21 to 22, whereby said deriving from said variation in magneto-resistance a corresponding value of said quantity comprises the steps of

- deriving from the dynamic measurement a degree of anisotropy of said at least one ferromagnetic element (106).
- deriving from said degree of anisotropy a corresponding value of said physical quantity.

24.- A method according to any of claims 21 to 23, whereby said variation in said parameter influenced by said at least one ferromagnetic element (106) is induced by the magnetisation or magnetisation direction of said ferromagnetic element (106).

25.- A method for creating a magnetic image , comprising

- allowing a plurality of ordered ferromagnetic elements (106) to interact with an environment of which an image is to be created
- generating a surface acoustic wave in a layer comprising piezoelectric material, interacting with said plurality of ordered ferromagnetic elements (106)
- dynamically measuring, for each of said plurality of ferromagnetic elements (106) the variation of characteristic parameters influenced by said ferromagnetic elements (106)
- deriving from said variation of said characteristic parameters a corresponding value of a physical quantity for each of said plurality of ferromagnetic elements (106).

26.- A method according to claim 25, wherein said physical quantity of each of said ferromagnetic elements (106) is a magneto resistance of said ferromagnetic elements (106).

27.- A method for creating a magnetic image according to any of claims 25 to 26, whereby said allowing the plurality of ordered ferromagnetic elements (106) to interact with an environment and said generating a surface acoustic wave is performed one time for all ferromagnetic elements (106)

in parallel and whereby said dynamically measuring the variation and said deriving a corresponding value is performed on a per ferromagnetic element (106) basis.

28.- A method for reading out a readout-value from at least one ferromagnetic element (106), comprising the steps of

- generating a surface acoustic wave, such that a precessional movement of a magnetisation in said at least one ferromagnetic element (106) is achieved and such that a corresponding magnetisation state of said at least one ferromagnetic element (106) is not switched,

- dynamically measuring a variation of a characteristic parameter influenced by said element,

- deriving from said variation of said characteristic parameter said read-out value.

29.- A method according to claim 28, wherein said characteristic parameter influenced by said ferromagnetic element (106) is a magneto resistance of said ferromagnetic element (106).

30.- A method according to any of claims 28 to 29, wherein said deriving from said variation of said characteristic parameter said read-out value comprises

- deriving a phase difference between the input signal applied to said surface acoustic wave generating means and the output signal obtained from said dynamic measurement of said characteristic parameter

- deriving from said phase difference a read-out value.

31.- A method according to claims 28 or 30, whereby said read-out value can correspond with only a number of distinct specific values.

32.- A method for switching at least one ferromagnetic element (106), comprising the step of generating a surface acoustic wave, for achieving a precessional movement of a magnetisation in said ferromagnetic element (106) and orienting a corresponding magnetisation state of said ferromagnetic element (106).

33.- A method for switching according to the claim 32, wherein said orienting of said magnetisation state of said ferromagnetic element (106) is

performed by generating a ferromagnetic element (106) specific additional field.

34.- A method for switching according any of claims 32 to 33, wherein said surface acoustic wave is a Rayleigh wave and whereby the angle between an easy axis of the ferromagnetic element (106) and the direction of the effective field is 90° during the first half period of the Rayleigh wave,
or
said surface acoustic wave is a shear wave and the angle between the direction of an easy axis of said ferromagnetic element (106) and the direction of the effective magnetic field generated by said device is larger than 45°, more preferably is larger than 80°, and most preferably is 90°.

35.- A method for for combined reading and writing of at least one ferromagnetic element, whereby a first surface acoustic wave generating means (102) is used for switching according to the method of any of claims 29 to 31 and asecond SAW generating means (402) is used for sensing or reading according to the method of any of claims 21 to 23 or 26 to 28.

36.- A method according to any of claims 21 to 35, wherein an additional magnetic field at the ferromagnetic resonance frequency or an integer multiple of said ferromagnetic resonance frequency ν_{FMR} is applied.

37.- A method according to claim 36, wherein said surface acoustic wave has a frequency ν_{SAW} substantially equal to said ferromagnetic resonance frequency ν_{FMR} or an integer multiple of said ferromagnetic resonance frequency ν_{FMR}.

38.- A method according to any of claims 36 to 37, wherein said integer multiple is an even integer multiple as for instance 2.

39.- A magnetic resonator (500) comprising a device (100) according to any of claims 1 to 20 and a tip (504), said tip (504) being made of magnetic material and supported by a cantilever-type (506) structure and furthermore being positioned near the ferromagnetic element (502) of said device (100).

40.- The use of a device (100) according to any of claims 1 to 20 for use in magnetic logic, whereby the application of a surface acoustic wave is the driving force of the magnetic logic .

41.- A method for active tuning of a working frequency of a surface acoustic wave, said method comprising the steps

- monitoring the absorption of a surface acoustic wave, generated by a surface acoustic wave generating means (102), by the ferromagnetic element (106)

- deriving from said absorption characteristics the difference between the working frequency of the surface acoustic wave and the ferromagnetic resonance frequency of said ferromagnetic element (106),

- tuning the working frequency of the surface acoustic wave generating means towards the ferromagnetic resonance frequency.

42.- A method according to claim 41 wherein said tuning of the working frequency of the surface acoustic wave generating means (102) towards the ferromagnetic resonance frequency is tuning the working frequency to a frequency slightly different from the ferromagnetic resonance frequency.

43.- A method according to claim 42 wherein said frequency corresponds with an absorption of said surface acoustic wave by said ferromagnetic element within 1% and 99%, preferably 50% and 90%, more preferably 70% and 90% of the absorption of said surface acoustic wave by said ferromagnetic element (106) at the ferromagnetic resonance frequency.